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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/716,796

11/20/2003

Raja Singh Tuli

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EXAMINER

DOLAN, JENNIFER M

ART UNIT

PAPER NUMBER

2813

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DELIVERY MODE

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PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary

Application No.

10/716,796

Applicant(s)

TULI ET AL.

Examiner

Jennifer M. Dolan

Art Unit

2813

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 13 September 2006.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-44 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 9-19 and 22-44 is/are allowed.
- 6) ☒ Claim(s) 1-8, 20 and 21 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 20 November 2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date 9/13/06.
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____.
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: _____.

DETAILED ACTION

This action is in response to the Amendment filed 13 September 2006

1. The Examiner notes the Applicant's petition to revive the abandoned application, filed 13 September 2006, and the subsequent granting of said petition on 23 February 2007.

Claim Rejections - 35 USC § 112

2. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

3. Claims 1-8 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claims 1-8 each recite a limitation of a "material of opposite conductivity," but fail to specify exactly to what layer(s) in the structure the conductivity is opposite. Thus, it is unclear as to whether the material of opposite conductivity has a conductivity opposite to the light sensing material, opposite to the carrier blocking layer, or opposite to the light emitting material.

For the purpose of examination, it is assumed that the material of opposite conductivity has a conductivity opposite to that of the light emitting layer.

Claim Rejections - 35 USC § 102

4. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

5. Claim 20 is rejected under 35 U.S.C. 102(b) as being anticipated by the Appl. Phys. Lett. Article (Vol. 57 No. 16) to Hiramoto et al. (cited by Applicant).

Hiramoto discloses a monolithic display device (figure 1), with an applied electric field across it (figure 1), comprising an n-type light emitting material (Alq3) and an n-type light sensing material (SiC) such that when the device is illuminated by a laser (page 1626; Ar-ion laser used as input source), photo-current amplification occurs within the device, causing light emission from the light emitting material (page 1626; column 1). Hiramoto further indicates that by use of different organic semiconductor materials, an IR – visible light conversion device can be formed (see page 1627, bottom of first full paragraph).

6. Claim 21 is rejected under 35 U.S.C. 102(b) as being anticipated by the Jpn. J. Appl. Phys. Article to Ni et al. (cited by Applicant).

Ni teaches a monolithic display device (figure 1, pg. 948) with an applied electric field across it (figure 1), comprising a light emitting material (n-type Alq3) and a light sensing material (p-type TiOPc) such that when the device is illuminated by a laser (pg 948, column 2)

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photo-current amplification occurs causing light emission from the light-emitting material (figure 2; page 948, last paragraph – page 949, first paragraph). It is noted that TiOPc is inherently sensitive to both visible and near IR light, and that Alq3 emits visible light, which makes it possible for a feedback effect to take place.

7. Claim 20 is rejected under 35 U.S.C. 102(e) as being anticipated by U.S. Patent No. 7,079,307 to Chun Liu et al.

Chun Liu discloses a monolithic display device with an applied electric field across it (figure 1), comprising a light emitting material (14) and a light sensing material (10), such that when the device is illuminated by a laser, photo-current amplification occurs causing light emission (column 3, lines 30-40; column 5, lines 15-35), wherein the light sensing area is sensitive to IR light only (figure 1; column 5, lines 1-10), and the light emitting area emits visible light only (figure 1; column 2, lines 50-60; column 5, lines 1-10, noting that the light emission may optionally be visible light).

Claim Rejections - 35 USC § 103

8. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

9. Claims 1-8 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hiramoto et al. in view of U. S. Patent Publication No. 2002/0125818 to Sato et al.

Hiramoto discloses a monolithic display device (figure 1), with an applied electric field across it (figure 1), comprising an n-type light emitting material (Alq3) and an n-type light sensing material (SiC) such that when the device is illuminated by a laser (page 1626; Ar-ion laser used as input source), photo-current amplification occurs within the device, causing light emission from the light emitting material (page 1626; column 1), where the light addressing is restricted such that as the area of light addressing on a screen (noting that the charge injection layer +electroluminescent layer constitute a screen) is transferred across a screen, the area of light emission does so identically to create an image (figure 1). Hiramoto further discloses a layer (PDA layer) having opposite conductivity to the light emitting layer (PDA is p-type) disposed after the light emitting layer (figure 1). Hiramoto further indicates photo-current amplification to cause light emission from the emissive material (figure 2; page 1626, column 1, first paragraph). It is further noted that generation of electron-hole pairs in the SiC region will inherently lead to a voltage imbalance, and that Au and PDA do not have an ohmic contact, and thus will have a potential barrier.

Hiramoto fails to teach inclusion of a carrier blocking layer between the light sensing and light emitting region.

Sato teaches that it is desirable to include a hole blocking layer between an electron transporting layer and the light emitting layer, to prevent holes injected into the light emitting layer from exiting through the other side of the layer and thereby improve the light emission efficiency of the device (see paragraph 0185; figure 2).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to add the hole blocking layer taught by Sato to the display device structure of

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Hiramoto. The rationale is as follows: A person having ordinary skill in the art would note that the n-type SiC light sensing layer in Hiramoto also functions as an electron transport layer, such that the structure in Hiramoto is a cathode, electron transport layer, light emitting layer, hole transport layer, and anode, stacked in order (see Hiramoto, figure 1). Since Sato teaches essentially the same structure as in Hiramoto (see Sato, figure 2), except including a hole blocking layer between the light emitting layer and the electron transporting layer, and since Sato further indicates that the inclusion of such a layer prevents holes injected into the light emitting layer from exiting the layer, and thereby improve the light emission efficiency of the device (Sato, see paragraph 0185; figure 2), it is expected that the addition of a hole blocking layer between the light emitting Alq layer and the electron transporting a-SiC:H layer in Hiramoto would result in the same advantages taught by Sato.

10. Claims 1-8 are rejected under 35 U.S.C. 103(a) as being unpatentable over the Appl. Phys. Lett (vol 66, No .22) to Katsume et al. article (cited by applicant) in view of Sato.

Katsume discloses a monolithic display device (figure 1) with an applied electric field comprising: an n-type light-emitting material (t-BuPh-PTC) and an n-type light sensing material (Me-PTC) such that when the device is illuminated by a laser (figure 1; input light pattern), photo-current amplification occurs in the device, causing emission (figure 3; page 2993, first column), and such that when the addressing light is transferred across a screen, the light emission does so identically to create an image (figure 1). Katsume further teaches that the illumination causes carriers to be formed that lower a voltage barrier at a semiconductor junction or voltage imbalance, causing an amplified amount of carriers i.e. (photo-amplification) to flow towards the

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light emitting area (page 2992, column 2 – 2993, column 1). Katsume further indicates a material having an opposite conductivity to the light emitting material (p-type PDA – see figure 1) disposed after the light emitting material. It is inherently the case that the ITO and PDA will have some sort of potential barrier, as well as the Au to Me-PTC contact.

Katsume fails to teach inclusion of a carrier blocking layer between the light sensing and light emitting region.

Sato teaches that it is desirable to include a hole blocking layer between an electron transporting layer and the light emitting layer, to prevent holes injected into the light emitting layer from exiting through the other side of the layer and thereby improve the light emission efficiency of the device (see paragraph 0185; figure 2).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to add the hole blocking layer taught by Sato to the display device structure of Katsume. The rationale is as follows: A person having ordinary skill in the art would note that the n-type Me-PTC light sensing layer in Katsume also functions as an electron transport layer (see Katsume, page 2002, col. 2. second paragraph, noting that the Me-PTC injects electrons from Au electrode to the t-BuPh-PTC layer), such that the structure in Katsume is a cathode, electron transport layer, light emitting layer, hole transport layer, and anode, stacked in order (see Katsume, figure 1). Since Sato teaches essentially the same structure as in Kasume (see Sato, figure 2), except including a hole blocking layer between the light emitting layer and the electron transporting layer, and since Sato further indicates that the inclusion of such a layer prevents holes injected into the light emitting layer from exiting the layer, and thereby improve the light emission efficiency of the device (Sato, see paragraph 0185; figure 2), it is expected that

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the addition of a hole blocking layer between the light emitting t-BuPh-PTC layer and the electron transporting Me-PTC layer in Katsume would result in the same advantages taught by Sato

Allowable Subject Matter

11. Claims 9-19 and 22-44 are allowed for reasons deemed to be of record, as set forth in the Office Action of 01 June 2005. The Examiner notes that for claim 27 and all claims dependent thereon, that although Hiramoto and Katsume teach the inclusion of a p-type material positioned on the side of the light emitting material opposite to that of the light sensing material, both Hiramoto and Katsume teach that the p-type layer is used as a hole transporting layer for injecting holes from a cathode into the light emitting material. There is no motivation, however, for using such a layer adjacent to an electron-injecting anode, wherein the cathode and light sensing material are used for hole-injection into the light emitting layer. Claim 27 is considered to be a PNP structure analogous to the NPN structure of claim 9, and allowable for essentially the same reasons, as set forth in the 01 June 2005 Office Action.

Response to Arguments

12. Applicant's arguments with respect to claims 1-8, 20, and 21 have been considered but are largely moot in view of the new grounds of rejection.

The Examiner notes the following about the Applicant's arguments/amendment:

The Applicant's arguments regarding the rejection under 35 U.S.C. 112 of claims 15-18, 35, and 36, particularly pertaining to the use of Alq3 including hole or electron trapping dopants, are found persuasive. Thus, this rejection has been withdrawn.

The Applicant argues that claims 1-8 have been amended to include the PNP or NPN structures previously indicated as allowable. This is not precisely correct, since claims 1-8, as amended, make no requirements indicating that the light sensing and light emitting layers must have opposite conductivity, and since the claims further don't require that the layer having opposite conductivity to the light emitting layer must be interposed between the light emitting layer and an anode, rather than being interposed between the light emitting layer and a cathode.

Claims 20 and 21 had been previously indicated as allowable by virtue of dependence upon allowable claim 13. Since claims 20-21 have been amended to become independent claims, but without retaining the limitations of claim 13, they are no longer deemed allowable.

Conclusion

13. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

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Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jennifer M. Dolan whose telephone number is (571) 272-1690. The examiner can normally be reached on Monday-Friday 8:30am-5:00pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Carl W. Whitehead, Jr. can be reached on (571) 272-1702. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Jennifer M. Dolan
Examiner
Art Unit 2813

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